SECTION IV-3: SET-UP AND INSPECTION OF MILKING EQUIPMENT

3. SET-UP AND INSPECTION OF MILKING EQUIPMENT

Having a standardized inspection of milking equipment on a regular basis is important to make sure that the system is functioning properly. For an excellent overview of the components of a milking machine system, visit the FAO website[1]. Proper inspection should be done by an equipment dealer representative on an annual basis, and if particular issues arise. On a daily basis, the system should be looked over by producers to see detrimental fluctuations which could influence it's efficiency.

3.1 PROPER SET-UP OF MILKING EQUIPMENT FOR DAIRY SHEEP

Sheep are different from cows in that they have lower milk production, higher fat levels, smaller teat orifices and larger cisterns as a proportion of daily milk production. For all of these reasons, set-up of equipment may be different that the dairy cow. The following recommendations come from the International Dairy Federation (IDF)[2] and the Dairy Practices Council ® (USA) (DPC)[3].

3.1.1 VACUUM

VACUUM LEVEL

The recommended claw vacuum at peak flow is 9.5 to 11.5 in of mercury (inches Hg) or 32.5 to 39 kilopascals (kPa). Usually to achieve this, the system is set-up as indicated below:

- High Line = 12.5-13.5 " Hg; 42-46 kPa
- Low Line = 10.5-12 " Hg; 36-41 kPa
- Mid Line = 11.5-13 " Hg; 39-44 kPa

Higher values may lead to teat-end damage and slower milking. Lower values may lead to units dropping off during milking.

Fig. 1 Vacuum gauge

VACUUM LINES

The materials used for the vacuum lines should be able to withstand vacuum levels of 85 kPa (25" Hg). For the main vacuum line length and diameter recommendations, consult the "Dairy Practices Council® Guideline for the Design, Installation and Cleaning of Small Ruminant Milking Systems" (DPC 70, 2000).

[1] FAO United Nations http://www.fao.org/docrep/004/t0218e/t0218e02.htm
[2] International Dairy Federation http://www.fil-idf.org/Public/ColumnsPage.php?ID=23077
[3] Dairy Practices Council http://www.dairypc.org/

VACUUM PUMP

Vacuum pumps need to be located close to the parlour but in a clean and dry location, free of dust and extremes of heat and cold. The document DPC 70, 2000 – provides recommendations of the air flow requirements needed for milking and washing – both for bucket systems and pipeline systems. It also provides recommendations on changes needed if the farm is located above 300 m (1000 ft) sea level, as more vacuum is required to compensate for the thinner air.

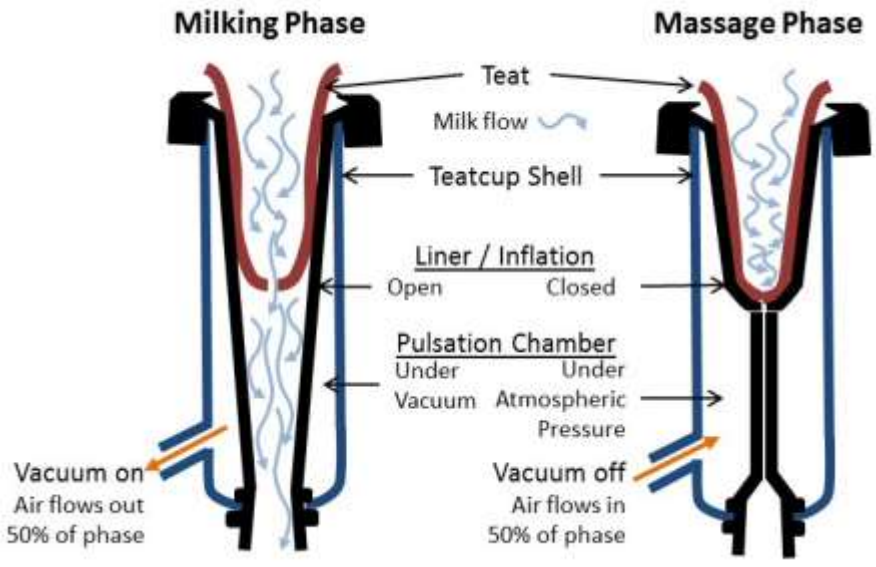
VACUUM RESERVE

Sufficient vacuum reserve is necessary to prevent liner slips and squawks, drop-off of inflations and drop in vacuum resulting in fluctuations and milk impacts. Information that is used to calculate this amount includes: type of milking system (pipeline versus bucket); number of units; whether conventional clusters or those with automatic teat cup valves; and whether an automatic shut-off valve is used with the cluster. Elevation is also important as more reserve is needed at higher elevations above 300 m (1000 ft) sea level. Tables are available in the IDF Bulletin 370 (2002) so that a specific recommendation can be made for your facility.

3.1.2 PULSATIONS

The pulsations allow for vacuum changes in the teat liner / inflation to gently squeeze the teat sphincter to open and shut, allowing for removal of milk (Fig. 2). During the milking phase, the vacuum removes the air from the pulsation chamber – the space between the liner and the shell of the teat cup. This forces the teat sphincter open and allows milk to be pulled from the teat. When the vacuum is shut off, air enters the pulsation chamber, collapsing the liner and allowing the teat sphincter to close. Milk does not flow and the teat relaxes. Changes from the milking phase to the massage phase must be rapid to allow blood to flow back into the teat during the massage phase.

Fig. 2 Action of the teat cup during maching milking



PULSATION RATE

For dairy sheep, the recommended rate is 90 to 180 cycles / min, with 120 cycles being most commonly recommended. There must be adequate rest time between each cycle to allow for blood flow back into the teat. If not, then teat damage may occur. For this reason, adapted pulsators designed for use in dairy cows should not be used as the change from open to closed and open again may not be fast enough given how rapid the pulsations are.

Fig. 3 Pulsation rate and ratio

PULSATOR RATIO

Pulsator ratios are usually between 50% and 60%, similar to dairy cattle, with 50% most commonly recommended. The pulsator ratios should not vary between units by more than 5%.

PULSATION LINES

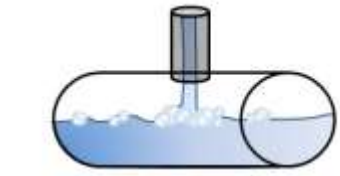
The vacuum line to the pulsators should be 2 in (48 mm) in diameter. If using more than 36 milking units, the diameter should be 3 in (73 mm). The slope should be 0.4% (4 mm per metre of line length) to the vacuum distribution tank.

3.1.3 MILKLINES

SLOPE OF THE MILKLINE

Milklines should have a continuous and even fall towards the receiver jar, with a minimum of 10 mm (1 cm) of drop for every metre of pipe. This translates into a minimum decline of 0.5%. For example, if the distance from the furthest sheep being milked to the receiver jar is 20 metres (66 ft), then the minimum drop must be 10 cm (~ 3").

Fig. 4 Milk flow through the line



Stratified flow through the milkline. No risk of flooding

Flooding of the milkline caused by slugging of milk. Worse when line enters low. Risk of backflow of milk to ewe and drop in vacuum.

COMPOSITION OF THE MILKLINE

The inside of the milkline should be as smooth as a Number 4 mill finish in stainless steel sheet. It needs to be free of any marring of the inside surface, e.g. pitting, cracks, crevices. All welds of joints, ferrules and gaskets should also be smooth with no pits. There should be inspection ports to allow for visual inspection of the inside of the milkline.

FLOW OF MILK THROUGH THE MILKLINE

The flow of milk inside the milkline should be at a level of less than 50%, i.e. there should be more air above the level of milk than milk below. This is called "stratified flow" (Fig. 4). Slugs of milk flowing through the milkline, where the level of milk fills the milkline, will cause a drop in vacuum (usually greater than 2 kPa) and result in longer milking times, and more liner slips.

Flow rates of milk will vary between breeds of sheep and perhaps between stage of lactation. The following milk flow rates have been suggested by the IDF:

- Low milk flow animals = a maximum of 0.8 L of milk/ min
- Medium milk flow animals = a maximum of 1.3 L of milk / min
- High milk flow animals = a maximum of 2.7 L of milk / min

If flooding occurs during peak milk times (e.g. when ewes are in early lactation), you may need to decrease the number of units on at any one time to prevent "seasonal" flooding.

Based on research, sheep tend to either milk-out quickly (75 to 100 sec), or slowly (125 to 200 sec), with most milking out in less than 2 min (120 sec). High milk flow animals tend to milk out more quickly than low milk flow animals.

Milk flow rates and volumes will vary by number of units being used and type of animal being milked (flow rate and length of time for milk-out). Udder stimulation and subsequent milk-let down will also impact milk flow.

To calculate the minimum diameter of the milkline needed to keep a stratified milk flow, consult the IDF Bulletin 370 (2002), using information on expected maximum milk flow, number of units, type of milk-line (dead-end versus looped) and slope.

3.1.4 MILKING CLUSTER

CLAW

Milking clusters may or may not use a claw. The claw of the cluster should be large enough so no flooding occurs during maximum milk-out. If flooding occurs, milk may move from one teat cup to the other and transfer mastitis bacteria to the other gland.

Fig. 5. Claw size large enough?

INFLATIONS

The size of the inflation opening should be adequate for the teat size of the sheep. Recommendations on inflation maintenance are provided in Section IV.3.2.1.

AIR VENTS

The milking cluster requires air vents so that the milklines do not become flooded. The air vents are located either in or near the claw or in the tube close to the teat cup inflation. They should be as small as needed to allow milk to move without flooding.

SHUT-OFF VALVE

There should be a shut-off valve installed to break the vacuum between the milk line and the inflation. This should be used every time a milking unit is removed. Automatic shut-off valves are recommended but must be properly calibrated so that sheep are not over or under-milked.

Fig. 6 Shut-off valve

MILK HOSES FROM TEAT CUP TO MILKLINE

If no claw, the milk hoses from each teat cup to the bucket or milkline should extend long enough (1 m) to prevent milk flow back to the other gland. However, they should not be longer than 3 m (9 ft). They should enter the pipeline perpendicular and at the top half of the line.

Fig. 7 Milk hoses long enough?

3.1.5 RECEIVER TO MILK TANK

RECEIVER

The receiver jar should be located in the milk-room or parlour. From the receiver jar, one line goes from the top of the jar to the trap - preventing milk or cleaning solution from entering the vacuum distribution tank. Another line goes to the bulk tank. A probe within the jar when triggered by the rising milk level will start the milk pump to move the milk from the jar to the bulk tank. Flooring should be impervious, washable and with an adequate and well-maintained drain. Souring milk will also cause bad odours which may be absorbed by the saleable milk.

Fig. 8 Receiver jar with milk pump and trap

MILK FILTERS

All milk (whether going through a pipeline or strainer) must be filtered prior to storage. Use only filters designed for use with milk and replace after each milking. Milk filters (in-line and strainer-type) should be replaced before or after each cleaning as determined by milking equipment manufacturer's recommendations. The filter will screen out debris and sediment (such as straw and large dirt particles) and some mastitic milk (i.e. clots). Checking the filter for signs of mastitis and other debris can help you to identify problems (e.g. adequate udder preparation (Fig. 10). The filter is not a replacement for proper udder and teat preparation (see Section III.1.1). Filters should also be used for hand-milking before the milk enters the bulk tank or bucket for storage (Fig. 9).

Fig. 10. Cleanliness of the milk filter reflects udder preparation & health. Left: filter containing feed material & manure. Right: little dirt indicating good udder prep.

Fig. 9. Milk poured through a strainer fitted with a filter. System used with hand-milking operation.

3.2 MAINTENANCE OF EQUIPMENT

Fig. 11. Monitor temperature of bulk tank

It is important to monitor milking equipment on a regular basis to determine if maintenance needs to be performed. Daily monitoring of the bulk tank temperature to identify inconsistencies is important to the maintenance of milk quality (Fig. 11). Weekly monitoring of pre-rinse or wash water, as well as inspection of problem areas in the milking equipment should be done to monitor build-ups, cracks and leaks. If there are any issues at these weekly inspections, maintenance should be done by producers, or by equipment dealers as soon as possible after the problem is detected.

The system should have a thorough evaluation completed by an equipment dealer annually to make sure the equipment is functioning properly. In addition, oil for the vacuum pump should be monitored and changed when needed. The vacuum pump, as well as the valves and screens need to be cleaned twice a year. Inflations should be changed as required, as set by the equipment dealer, or if there is a leak.

3.2.1 REPLACE MILK INFLATIONS (LINERS)

Milk inflations need to be replaced when worn. Rough inking and porous inflations can harbour bacteria and negatively impact milk quality. Worn inflations can harm teat end health predisposing ewes to mastitis. Breakdown of silicon will allow milk fat and solids to migrate into shells (the outer portion of the teat cup). Bacteria can also increase risk of mastitis.

GUIDELINE FOR REPLACEMENT

This can be calculated based on the rating of the inflations and how often they are used.

Fig. 12. Worn inflation

1. Number of milkings / day for each unit = (# milking sheep / # of milking units) X 2
2. Number of days to change inflations = # of milkings/day (#1)

E.g.
200 ewes milking in a 24 unit parlour, being milked twice day = (200/24) X 2 approximately 17.
If using silicone inflations with a rating of 6500 milkings, then inflations should be changed every (6500/17) = 390 days. If using rubber inflations, the rating is much lower, i.e. ~ 1500 milkings or as per the equipment dealer.

Sometimes the inflations need to be replaced more often than manufacturer's recommendations. Things that can influence this:

- If > 60 cycles/min is used as is the case with sheep, where 120 to 150 is most commonly used, they may wear faster.
- If the ratio of washings to milking is higher (e.g. smaller dairy with same number of units used), the inflations may also wear out with fewer milkings.
- Excessive chlorine use.

3.2.2 MONITOR AND REPLACE RUBBER WARE

As with milk inflations, rubber ware breaks down with time, use, exposure to heat, cold and chemicals. Worn parts can harbour bacteria and leak milk. Rubber, which is breaking down, leaves a black residue called "inking" on surfaces. This is a sign that the rubber part needs replacement.

Fig. 13. Inking from rubber breakdown

GUIDELINES FOR REPLACEMENT

- Replace silicone milk hoses every 2 years
- Replace plastic milk hoses every year
- Replace black gaskets every year
- Replace silicone gaskets every year
- Follow guidelines of dealer unless worn rubber indicates more frequent replacement is needed

3.2.3 CHECK FOR RESIDUES AND WEAR ON EQUIPMENT

- Manually cleaning of the jetter cups will increase their life expectancy
- Check the milk wash plug for inking. Check it also for cleanliness. If a short plug is used for milking, make sure it is manually cleaned after each milking.
- If a jet tube tank washer is used, check the outlet valve and clean routinely. Keep the tip of the jet tube up off the floor to keep cleaner. Check for wear on the impeller – remove to inspect.
- Inspect the washer pump hose for debris. The spray ball may plug with debris – a cap may reduce this.
- Periodically inspect and clean shut-off valves.

Fig. 14 Check sanitary trap for cleanliness

3.2.4 BULK TANK MAINTENANCE

VISUALLY INSPECT THE TANK AFTER WASHING

Open the hatch after washing and let the surfaces dry before inspecting (Fig. 15). Wet stainless steel will appear clean. Water beading may indicate a fat film. A blue rainbow haze may indicate a protein film. A greyish film (lack of shininess to surface) may indicate a biofilm, which is essentially a layer of bacteria growing on the metal surface of your tank and lines – very important if a problem with high bacterial counts exists!

Fig. 15 Check tank for milk residues

INSPECT TANK HATCH AND OUTLET VALVES

Residues can build up around the tank hatch. The lid gasket, breather and exterior need frequent inspection and cleaning. The tank outlet valve should be cleaned every milk collection / tank wash day (Fig. 16).

Fig. 16 Milk tank equipment needs to be inspected and cleaned after every pick-up

3.2.5 WASH CONTROL BOX MAINTENANCE

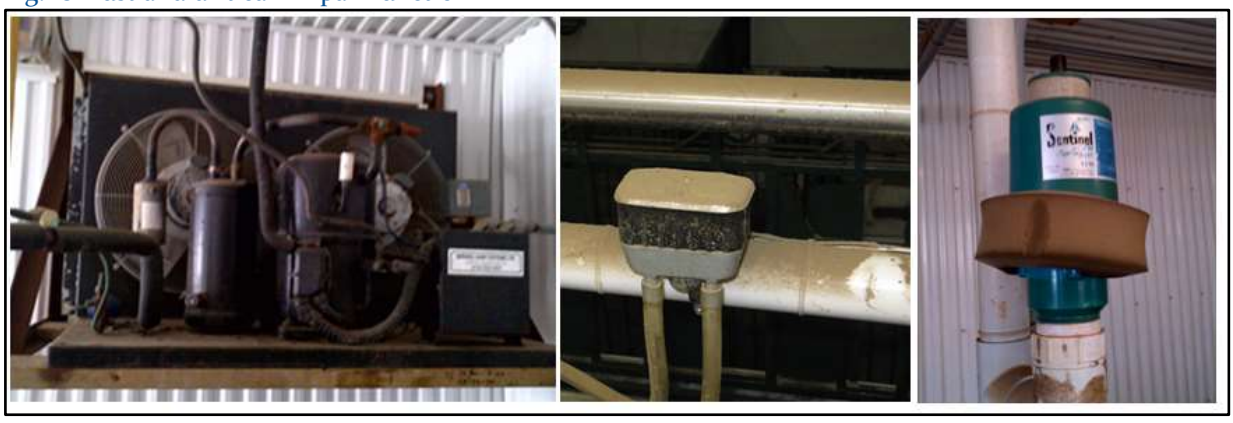
Check and clean the screens on the hot and cold inlet hoses. If the water is hard, calcium deposits can build up. Repair any leaks at the chemical dispensing jars promptly. Leaks will result in a loss of the cleaning chemicals.

Fig. 17 Was control box in good repair

3.2.6 CLEAN DUST AND DIRT FROM EQUIPMENT AND HOUSING

Equipment, particularly those with electronic components (e.g. pulsators, vacuum regulator pumps, air injectors, heaters), should be kept dust-free to assure proper operation. It is very important to keep the radiator of the condenser unit free of dust and dirt (Fig. 18) to ensure effective and efficient milk cooling. Parlours can be a dirty place which means that regular cleaning is necessary to keep things working right. Use of screens on the windows, regular fly control in the parlour and milk house, air filters on intake fans will all help – but attention and care to keeping delicate equipment clean must be done.

Fig. 18 Dust and dirt can impair function



FLY CONTROL

Flies are attracted to organic material and carry many bacteria. The parlour should be kept free of manure, urine, spilled milk and residual feed. It should be designed so it can be frequently cleaned. Areas in the milk house which may attract flies include the garbage (e.g. soiled milk filters), drain areas, dirty buckets, etc. Keep all areas clean and sanitized and remove garbage frequently. Keep flies out by having intact screens on all windows and doors. Fly bait – approved for use in livestock premises, can be used if fly build-up becomes a problem. Keep window sills free of debris and moisture. Floors should be kept swept and clean, particularly around drains which should also be cleaned frequently. Other fly sources to consider include manure storage facilities and dead-stock composting areas. Locate those away from the milking area and milk house. Don't give the flies a reason to be attracted.

3.2.7 WASH SINK

Keep non-essential items out of the sink (e.g. milk bottles and nipples). Ideally, a cover should be in place over the sink. This will help to maintain water temperatures as well as keep debris out.

A coarse screen should be put on the end of the suck pipe to prevent debris from being sucked up. This debris can accumulate in the wash line and restrict flow to the jetters. For systems that are Clean In Place (CIP), the suck pipe should not draw air during the cleaning cycles. Corrective actions should include consulting with your equipment dealer. Make sure drain stay clear and clean as well to allow for dirty water to get away quickly.

Fig. 19 Covered wash sink helps maintain temperature of wash water